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Egg Yolk Pigmentation with Dehydrated Alfalfa Meal, Pro-Xan and Xanthophyll-free Freeze Dried Alfalfa Juice

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This study concludes a series of tests in which natural and synthetic materials were used to produce deeply pigmented egg yolk. The most efficient pigmenter used was β-apo 8' carotenoic acid ethyl ester followed by β-apo 8' carotenal, alfalfa concentrates and meals of alfalfa, corn gluten and marigold petals. In this test pure lutein, dehydrated alfalfa meal and Pro-Xan, an alfalfa concentrate, were used as sources of pigments[2]. The freeze dried alfalfa juice was tested for its possible effect in enhancing the utilization of pure lutein. Caged hens were depleted of body stored pigments by feeding an essentially pigment free, milo-soy diet for 12 months. Pigmenting materials were then added to the milo-soy basal to provide dietary pigment at levels of 10 and 20 ppm as shown in table 1.

The 17% protein dehydrated alfalfa meal analyzed 322 ppm xanthophyll. The Pro-Xan, a protein-xanthophyll concentrate of alfalfa, contained 40% crude protein and 1067 ppm xanthophyll. The lutein (a common name for xanthophyll) was extracted from the freeze dried alfalfa juice. The residue of the alfalfa juice was fed in diets 5, 6, 7 and 8 at levels equivalent to juice levels. The extracted lutein fed in diets 7, 8, 9 and 10 had a concentration of 6900 ppm.

The concentration of pigment in the egg yolk was chemically determined and expressed as micrograms of β-carotene equivalents (BCE) per gram of yolk. Utilization of the pigment was then calculated from data on feed consumption and weight of egg produced. The test covered a 49-day feeding period, being limited by the amount of lutein that was available.

The BCE values in table 1 show that doubling the amount of pigment in the diet does not double the amount of pigment found in the yolk. The efficiency of utilization decreases as the amount of pigment increases in the diet. This effect has been observed in previous tests. Other factors such as the source of the pigments and the rate of egg production also affect deposition of pigment in the egg yolk.

The concentration of pigment in the yolk from the dehydrated alfalfa more than doubled when the concentration of dietary pigment increased from 10 to 20 ppm. The hens in group 2 were producing at the rate of 34%, while production of the other groups was within the range of 50%. Similar effects have been observed in other tests. Apparently, more pigment accumulates in the yolk when the rate of ovulation declines.

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[2]All products were obtained from the Western Regional Laboratories, U.S.D.A., Berkeley, California, through the courtesy of Dr. G. O. Kohler.

There were no significant differences in egg production, efficiency of pigment utilization and yolk BCE values for Pro-Xan, the freeze dried alfalfa juice, the lutein extract or the latter combination. Based on the conditions of this test, xanthophyll utilization from Pro-Xan and lutein would be considered to be superior to that from dehydrated alfalfa.

Table 1. Utilization and Effects of Dehydrated Alfalfa, Pro-Xan and Freeze Dried Alfalfa Juice on Yolk Pigmentation and Egg Production

Treatment[1]	Dietary xanthophyll	Yolk BCE	Utilization efficiency	Hen-day production
	ppm	ppm	%	%
1. Dehydrated alfalfa	10	20.0c[5]	19.0	51.3
2. Dehydrated alfalfa	20	48.0b	14.5	34.4
3. Pro-Xan[2]	10	44.3b	35.9	45.8
4. Pro-Xan	20	70.4a	33.3	51.6
5. F.D. juice[3]	10	0.9c	--	45.6
6. F.D. juice	20	2.7c	--	44.3
7. F.D. + lutein	10	43.8b	43.8	46.3
8. F.D. + lutein	20	63.3a	32.5	52.5
9. Lutein[4]	10	45.8b	43.6	52.9
10. Lutein	20	64.4a	32.9	55.5
11. Basal	--	1.9c	--	43.8
12. Basal	--	0.4c	--	43.6

[1]Basal plus indicated source of pigment.
[2]Alfalfa protein-xanthophyll concentrate.
[3]Freeze dried alfalfa juice.
[4]Crystalline lutein in corn oil.
[5]Values with same subscript not significantly different, $P<.05$.